example, a corrosion resistant coating provided on a turbine blade of an aircraft engine, a heat resistant, wear and abrasion resistant coating provided on an exhaust valve of an automobile engine and a corrosion resistant, oxidation resistant coating provided on an exhaust system of a garbage incinerator and further can be applied to a buildup welding for repairing parts thereof.

As described under "Background of the Invention" beginning at page 1, line 20 of the specification, it has been known to coat the surface of a metal material with an intermetallic compound in order to impart corrosion resistance, and wear and abrasion resistance thereto, by various processes, such as diffusion processes, flame spraying processes, and self-propagating high temperature synthesis or combustion synthesis processes. These processes, however, have been problematical, as described in the specification.

As recited in above-amended Claim 1, the present invention is a method of forming a coating layer of an intermetallic compound on a base material, comprising the steps of: piling up a first substance in powdery form or molten form on a base material, and delivering a second substance in powdery form or molten form onto the first substance, the second substance reacted with the first substance to thereby form a coating layer of an intermetallic compound on the base material, and at least one of the first substance and the second substance is in molten form, and wherein each of the first substance and second substance comprises at least one metal.

As recited in above-amended Claim 2, the present invention is also a method of welding a plurality of base materials to each other with an intermetallic compound, comprising the steps of: piling up a first substance in powdery form or molten form on the base materials, and delivering a second substance in powdery form or molten form onto the first substance, the second substance reacted with the first substance to thereby cause the

plurality of base materials to be bonded to each other through a coating layer of an intermetallic compound, and at least one of the first substance and the second substance is in molten form, and wherein each of the first substance and the second substance comprises at least one metal.

Thus, in terms of physical form of the first substance and second substance, the inventions include embodiments wherein both are in molten form; one is in powdery form and the other is in molten form; and vice-versa.

For example, when a nickel powder is first fed to a surface of a base material and subsequently a molten aluminum metal or an alloy thereof is placed thereon, both the metals upon contacting each other undergo a violent exothermic reaction. Thus, a nickel/aluminum intermetallic compound (NiAl) is formed and due to the heat of reaction, bonding thereof to the metal base material. As a result, a coating layer or a buildup welding of an intermetallic compound, such as an aluminide, expected to provide a heat resistant material of high strength, can be accomplished.

In the method of the present inventions, synthesis of the coating layer and bonding thereof to a base material or base materials are simultaneously carried out by way of an exothermic reaction between different types of metals in which an intermetallic compound is formed. By such a method, the base material can be coated and a plurality of base materials can be bonded to each other by welding, easily and effectively, and with reduced energy consumption within a short period of time. Since the metals of the first and second substance are separately fed, the temperatures thereof can be controlled independently, and as a result, the reaction and initiation temperature can be freely controlled. Therefore, the melt depth of the base material can be controlled. Thus, increasing bonding strength with regard to not only thick coatings but also thin coatings can be realized.

Also, the coating layer can be formed in an energetically advantageous manner wherein a heat source of relatively low capacity, such as a high-frequency heater or resistance heater, can be used.

In addition, and as recited in Claim 12, coating can be formed freely and automatically with the use of a CAD/CAM system permitting computerized fine control.

The rejection of Claims 1, 3-11 and 15 under 35 U.S.C. § 102(b) as anticipated by U.S. 6,051,277 (Claussen et al), is respectfully traversed. Claussen et al describe forming a cerametallic composite part by reacting an oxide-containing preform with molten Al or an Al alloy such that the resulting product contains Al_2O_3 and aluminide (column 4, lines 16-22). In general, the oxide-containing preform of Claussen et al is a compound reducible by aluminum (column 4, lines 47-53). Thus, for example, when the oxide-containing preform contains TiO_2, it is reduced by the aluminum, thereby forming Al_2O_3 and TiAl (column 4, lines 23-28).

Claussen et al neither disclose nor suggest the presently-claimed invention, which requires that two separate metals react to form an intermetallic compound, rather than the reaction of a metal with an oxidic compound reducible by the metal, even when the metal is aluminum. While the present invention does not exclude the presence of metal oxides, they are not required. Nor does Claussen et al disclose the reaction of two materials, one being in molten form, the other being in powder form, or both being in molten form. Indeed, while Claussen et al disclose that their preform may contain elements which react with molten aluminum to form aluminides (column 5, lines 30-33), Claussen et al neither discloses nor suggests applying the preform in the form of a powder or molten material to a base material or to a base material already containing a substance in powdery or molten form.

For all the above reasons, it is respectfully requested that the rejection over Claussen et al be withdrawn.

The rejection of Claim 1, 3-7 and 11 under 35 U.S.C. § 102(b) as anticipated by U.S. 5,997,604 (Rafferty et al), is respectfully traversed. Aside from the fact that Rafferty et al discloses coating with a metal or alloy (the MCrAlY therein is an alloy, not an intermetallic compound), as opposed to the presently-recited intermetallic compound, along with other differences between the basic invention herein and Rafferty et al, it is noted that all of the present claims now contain the limitations of original Claim 8, not subject to this rejection. Accordingly, it is respectfully requested that it be withdrawn.

Applicants gratefully acknowledge the indication of allowability of Claims 2, 12 and 14. Since Claims 2 and 12 were independent, and Claim 14 depends on Claim 12, these claims were presumably allowable as is. Nevertheless, Applicants respectfully submit that all of the presently pending and active claims in this application are now in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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IN THE CLAIMS

1. (Amended) A method of forming a coating layer of an intermetallic compound on a base material, comprising the steps of:

piling up a first substance in powdery form or molten form on a base material, and

delivering a second substance in powdery form or molten form onto the first substance,

the second substance reacted with the first substance to thereby form a coating layer of an intermetallic compound on the base material, and

at least one of the first substance and the second substance is in molten form,

and wherein each of the first substance and second substance comprises at least one metal.

2. (Amended) A method of welding a plurality of base materials to each other with an intermetallic compound, comprising the steps of:

piling up a first substance in powdery form or molten form on the base materials, and

delivering a second substance in powdery form or molten form onto the first substance,

the second substance reacted with the first substance to thereby cause the plurality of base materials to be bonded to each other through a coating layer of an intermetallic

compound, and

at least one of the first substance and the second substance is in molten form,

and wherein each of the first substance and the second substance comprises at least one metal.

3. (Amended) The method as claimed in claim 1 [or 2], wherein said coating layer of an intermetallic compound is [a building up coating layer is formed on a base material surface, the building up coating layer being] fused to the base material.

4. (Amended) The method as claimed in claim 1 [or 2], wherein the first substance [is constituted of] comprises at least one metal selected from the group consisting of nickel, cobalt, iron, niobium, vanadium, molybdenum, tungsten, chromium and tantalum.

5. (Amended) The method as claimed in claim 1 [or 2], wherein the second substance [is constituted of] comprises at least one metal selected from the group consisting of aluminum and titanium.

6. (Amended) The method as claimed in claim 1 [or 2], wherein the base material [or base materials are constituted of] comprises a substance which is a metal or alloy of at least one member selected from the group consisting of iron, nickel, cobalt, aluminum and niobium.

7. (Amended) The method as claimed in claim 1 [or 2], wherein the base material [or base materials are constituted of] comprises a substance which is at least one metal selected from the group consisting of metals of the first substance, metals other than metals of the first substance but in the same group thereof of the periodic table, [and] metals of the second substance, and metals other than metals of the second substance but in the same group thereof of the periodic table [or a metal homologous thereto].

8. (Canceled).

9. (Amended) The method as claimed in claim 1 [or 2], wherein the first substance additionally contains a ceramic.

10. (Twice Amended) The method as claimed in claim 1, wherein the first substance is in powdery form or molten form and additionally contains a powdery or fibrous ceramic [constituted of an] comprising an oxide, carbide, nitride or boride of at least one metal selected from the group consisting of aluminum, ytrrium, titanium, zirconium, hafnium and silicon.

11. (Amended) The method as claimed in claim 1 [or 2], wherein a coating layer [constituted of] comprising an intermetallic compound, an intermetallic compound having a ceramic dispersed therein, or an intermetallic compound containing a nitride is formed by the reaction between the first substance and the second substance.

14. (Amended) The method as claimed in claim 2, wherein the first substance is in powdery form or molten form and additionally contains a powdery or fibrous ceramic [constituted of] comprising an oxide, carbide, nitride or boride of at least one metal selected from the group consisting of aluminum, yttrium, titanium, zirconium, hafnium and silicon.

15. (Amended) The method as claimed in claim 9, wherein the first substance is in powdery form or molten form and additionally contains a powdery or fibrous ceramic [constituted of] comprising an oxide, carbide, nitride or boride of at least one metal selected from the group consisting of aluminum, yttrium, titanium, zirconium, hafnium and silicon.

Claims 16-22 (New)